

WHAT IS CLAIMED IS:

1. A cooling device comprising:

a first substrate having grooves constituting a heat pipe formed therein so as to be exposed to the surface thereof, the grooves excluding at least the groove positioned in correspondence to a wick;

a second substrate made of a metal or a material having a thermal conductivity substantially equal to that of a metal, the second substrate having at least the groove for the wick formed at the surface thereof, said surface being joined to the first substrate; and

a third substrate into which the second substrate is incorporated so as to be exposed to the surface of the third substrate, said surface of the third substrate being joined to the first substrate;

at least one of the first substrate and the third substrate being made of a polyimide resin.

2. A cooling device according to Claim 1, further comprising a fourth substrate made of a metal or a material having a thermal conductivity substantially equal to a metal, the fourth substrate having at least a groove for a condenser formed on the surface thereof, said surface of the fourth substrate being joined to the first substrate, and the

fourth substrate being incorporated into the third substrate so as to be exposed to the surface of the third substrate.

3. A cooling device according to Claim 2, wherein at least one of the second substrate and the fourth substrate is made of a metal containing copper or nickel.

4. A cooling device according to Claim 1, wherein the first substrate has a diamond-like carbon film formed on the surfaces of the grooves.

5. A cooling device according to Claim 4, wherein the first substrate and the third substrate joined to each other are physically separated from each other into a region containing the second substrate and a region containing the condenser as a component of the heat pipe, and the cooling device further comprises a flexible substrate interposed between the separated regions, the flexible substrate having a flow-path formed therein so as to connect the wick and the condenser to each other.

6. A cooling device comprising:

a first member having at least a wick as a component of a heat pipe;

a second member physically separated from the first

member and provided with a condenser as a component of the heat pipe; and

a flexible substrate interposed between the first member and the second member and having a flow-path formed therein so as to connect the wick and the condenser to each other;

at least one of the first member and the second member being made of a polyimide resin.

7. A cooling device comprising:

a first substrate having open grooves constituting a heat pipe formed therein, the open groove excluding at least the open groove positioned in correspondence to a wick;

a second substrate made of a material having a thermal conductivity substantially equal to that of a metal, the second substrate having at least the groove for the wick formed at the surface thereof, said surface being joined to the first substrate;

a third substrate into which the second substrate is incorporated so as to be exposed to the surface of the third substrate, said surface of the third substrate being joined to the first substrate; and

a lid-substrate joined to the surface of the first substrate so as to cover said surface which is opposite to the side of the first substrate where the first substrate

and the second substrate are joined to each other;

at least one of the first substrate, the third substrate, and the lid-substrate being made of a polyimide resin.

8. A cooling device according to Claim 7, wherein the flow-path for a working fluid, formed by joining of the open grooves of the first substrate to the lid-substrate, has a diamond-like carbon film formed therein.

9. An electronic apparatus comprising:

a slot to or from which a card type storage device containing a flash memory and a driver can be attached or detached; and

a cooling device arranged adjacently to the slot,

the cooling device comprising a first substrate having grooves constituting a heat pipe formed therein so as to be exposed to the surface thereof, the groove excluding at least the groove positioned in correspondence to a wick,

a second substrate made of a metal or a material having a thermal conductivity substantially equal to that of a metal, the second substrate having at least the groove for the wick formed at the surface thereof, said surface being joined to the first substrate, and

a third substrate into which the second substrate is

incorporated so as to be exposed to the surface of the third substrate, said surface of the third substrate being joined to the first substrate,

the first substrate and the third substrate being made of a polyimide resin.

10. A display unit comprising:

a display section;

a driver for displaying; and

a cooling device,

the cooling device comprising a first substrate having grooves constitute a heat pipe formed therein to be exposed to the surface thereof, the groove excluding at least the groove positioned in correspondence to a wick,

a second substrate made of a metal or a material having a thermal conductivity substantially equal to that of a metal, the second substrate having at least the groove for the wick formed at the surface thereof, said surface being joined to the first substrate, and

a third substrate into which the second substrate is incorporated so as to be exposed to the surface of the third substrate, said surface of the third substrate being joined to the first substrate,

the first substrate and the third substrate being made of a polyimide resin.

11. An electronic apparatus comprising:
a central processing unit: and
a cooling device arranged adjacently to the central processing unit,

the cooling device comprising a first substrate having grooves constituting a heat pipe formed therein so as to be exposed to the surface thereof, the groove excluding at least the groove positioned in correspondence to a wick;

a second substrate made of a metal or a material having a thermal conductivity substantially equal to that of a metal, the second substrate having at least the groove for the wick formed at the surface thereof, said surface being joined to the first substrate; and

a third substrate into which the second substrate is incorporated so as to be exposed to the surface of the third substrate, said surface of the third substrate being joined to the first substrate;

the first substrate and the third substrate being made of a polyimide resin.

12. A method of producing a cooling device comprising the steps of:

forming a first substrate made of a polyimide resin and having grooves constituting a heat pipe formed therein so as

to be exposed to the surface thereof, the grooves excluding at least the groove positioned in correspondence to a wick,

forming a second substrate made of a metal or a material having a thermal conductivity substantially equal to that of a metal, the second substrate having at least the groove for the wick formed on the surface thereof;

incorporating the second substrate into a third substrate so as to be exposed to the surface of the third substrate; and

joining the surface of the surface of the first substrate and the one side of the third substrate to each other.

13. A method of producing a cooling device according to Claim 12, further comprising the steps of: forming a fourth substrate made of a metal or a material having a thermal conductivity substantially equal to a metal, the fourth substrate having at least a groove for a condenser formed on the surface thereof; and

incorporating the fourth substrate into the third substrate so as to be exposed to the surface of the third substrate.

14. A method of producing a cooling device according to Claim 12, further comprising the step of forming a

diamond-like carbon film in the grooves of the first substrate.

15. A method of producing a cooling device comprising the steps of:

forming a first substrate having open grooves constituting a heat pipe formed therein, the grooves excluding at least the groove positioned in correspondence to a wick;

forming a second substrate made of a metal or a material having a thermal conductivity substantially equal to that of a metal, the second substrate having at least the groove for the wick formed on the surface thereof;

forming a first surface of the first substrate to a lid-substrate to form a flow-path for a working liquid;

incorporating the second substrate into a third substrate so as to be exposed to the surface of the third substrate; and

joining the second surface of the first substrate to the surface of the third substrate.

16. A method of producing a cooling device according to Claim 15, further comprising the steps of:

forming a fourth substrate made of a metal or a material having a thermal conductivity substantially equal

to that of a metal, the fourth substrate having at least a groove for a condenser formed on the surface thereof; and

incorporating the fourth substrate into the third substrate so as to be exposed to the surface of the third substrate.

17. A method of producing a cooling device according to Claim 15, wherein the step of forming the flow-path for a working fluid includes a step of forming a diamond-like film on the surface of the flow-path.